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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,580	07/02/2003	David Henry Gurr	129159	5508

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EXAMINER	
KISH, JAMES M	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/613,580	GURR ET AL.	
	Examiner	Art Unit	
	James Kish	3737	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 May 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21,23 and 25-31* is/are rejected.

7)☒ Claim(s) *22 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-7, 9-10, 12, 17, 19, 21, 23 and 26-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US Patent No. 4,727,325) in view of Anand et al. (US Patent No. 6,414,487). Matsui discloses an NMR imaging method using rotating field gradients. The gradients (see Figure 6) produce a spiral sampling of k-space as can be seen in any of Figures 5B, 8 or 10. The system includes a sequencer under the control of a central processing unit (column 4, lines 13-15). Several reconstruction methods are discussed, such as Fourier transforming information on a diameter and then subjecting that data to back projection (column 3, lines 46-49), or data from circularly sampled data is re-gridded to rectangular coordinates by 2D interpolation, and undergoes 2D Fourier transformation, to obtain a desired image (column 6, lines 28-50). Also see column 9, line 55 through column 11, line 11 for disclosure on back-projection. Also disclosed is the fact that the frequency

coordinates are represented as a function of both sine and cosine functions (column 12, lines 62-68). The disclosure of Matsui is not limited to 2D and can be extended to 3D imaging, as stated at column 15, lines 35-39). However, Matsui does not use an elliptical sampling of k-space. Anand teaches that spiral and elliptical centric ordered trajectories through k-space have been employed in order to acquire the central portion of k-space first (column 1, lines 43-45). It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate an elliptical sampling of k-space because it is to be appreciated that the elliptical sampling geometry provides optimal k-space coverage for a given scan time (column 6, lines 62-64).

2. Claims 1-7, 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heid (US Patent No. 6,486,670) in view of Anand et al. (US Patent No. 6,414,487). Heid discloses a method for imaging with NMR wherein the k-space sampling proceeds along a curved path. The data is sampled on to a spiral trajectory in k-space and is then interpolated for placement onto a rectangular coordinate system. The method applies to both 2D and 3D imaging. See the section entitled "Summary of the Invention." The method uses spiral or echo-planar imaging techniques (column 2, lines 55-62). Also see column 3, line 34 through column 4, line 5. However, Matsui does not use an elliptical sampling of k-space. Anand teaches that spiral and elliptical centric ordered trajectories through k-space have been employed in order to acquire the central portion of k-space first (column 1, lines 43-45). It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate an

elliptical sampling of k-space because it is to be appreciated that the elliptical sampling geometry provides optimal k-space coverage for a given scan time (column 6, lines 62-64).

3. Claims 1-7, 10, 14, 19-20 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brittain (US Patent No. 6,794,869) in view of Anand et al. (US Patent No. 6,414,487). Brittain discloses a system and method for acquiring data to reconstruct MRI across a large FOV with reduced acquisition time. The phase encoding gradients for a 3D acquisition could also be positioned on concentric circles, in the shape of a spiral, in rays from the center of k-space, or in any other pattern. If a non-uniform placement is utilized, the data would be gridded in the transverse dimension(s) during reconstruction (column 13, lines 18-26). See column 7, lines 16-29 for a written description of Figure 5. Figure 5 demonstrates a reconstruction algorithm comprising Fourier transformation in the z-direction, followed by gridding of the data in k_x-k_y and finally Fourier transformation in the x and y-directions. The method provides stacks of images along the z-axis (column 5, lines 49-67). See column 13, lines 54-67 for discussion of contrast agents. However, Matsui does not use an elliptical sampling of k-space. Anand teaches that spiral and elliptical centric ordered trajectories through k-space have been employed in order to acquire the central portion of k-space first (column 1, lines 43-45). It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate an elliptical sampling of k-space

because it is to be appreciated that the elliptical sampling geometry provides optimal k-space coverage for a given scan time (column 6, lines 62-64).

4. Claims 1-8, 11, 13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mertelmeier et al. (US Patent App. No. 2002/0175683) in view of Anand et al. (US Patent No. 6,414,487). Mertelmeier discloses a method for fast acquisition of a MRI. The Fourier space is scanned with a raster of polar coordinates. In one reconstruction method as described, the received MR signals are subjected to a 1D Fourier transformation and are then reconstructed by means of a filtered back-projection (paragraph 5). The discussions of 2D also apply to 3D, as stated in paragraph 6. Also see paragraphs 15-17. However, Matsui does not use an elliptical sampling of k-space. Anand teaches that spiral and elliptical centric ordered trajectories through k-space have been employed in order to acquire the central portion of k-space first (column 1, lines 43-45). It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate an elliptical sampling of k-space because it is to be appreciated that the elliptical sampling geometry provides optimal k-space coverage for a given scan time (column 6, lines 62-64).

5. Claims 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. in view of Anand et al., further in view of Miyazaki et al. (US Patent No. 6,068,595). Matsui combined with Anand discloses an NMR imaging method using rotating field gradients and an elliptical sampling of k-space. The gradients (see Figure

6) produce a spiral sampling of k-space as can be seen in any of Figures 5B, 8 or 10. The system includes a sequencer under the control of a central processing unit (column 4, lines 13-15). Several reconstruction methods are discussed, such as Fourier transforming information on a diameter and then subjecting that data to back projection (column 3, lines 46-49), or data from circularly sampled data is re-gridded to rectangular coordinates by 2D interpolation, and undergoes 2D Fourier transformation, to obtain a desired image (column 6, lines 28-50). Also see column 9, line 55 through column 11, line 11 for disclosure on back-projection. Also disclosed is the fact that the frequency coordinates are represented as a function of both sine and cosine functions (column 12, lines 62-68). The disclosure of Matsui is not limited to 2D and can be extended to 3D imaging, as stated at column 15, lines 35-39). However, Matsui does not discuss maximum intensity projection (MIP). Miyazaki teaches to carry out synthesis of image data. One example of said synthesis is addition in which reconstructed image data items of a plurality of frames are added up pixel by pixel or MIP (column 5, line 56 through column 6, line 7). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use MIP, as taught by Miyazaki, in the method of Matsui in order to create an image with excellent depiction ability without the loss of information of directivities (see Abstract).

Allowable Subject Matter

6. Claims 22 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

For additional prior art relating to elliptical sampling of k-space, see PTO-892.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James Kish whose telephone number is 571-272-5554. The examiner can normally be reached on 8:30 - 5:00 ~ Mon. - Fri..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Casler can be reached on 571-272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMK

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